



### MODULE SPECIFICATION

Module code	
Module title in Polish	Wentylacja i klimatyzacja
Module title in English	Ventilation and Air Conditioning
Module running from the academic year	2016/2017

### A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	Environmental Engineering
Level of qualification	first cycle (first cycle, second cycle)
Programme type	academic (academic/practical)
Mode of study	full-time (full-time/part-time)
Specialism	Sanitary Pipelines and Systems; Water Supply, Treatment of Wastewater and Solid Waste
Organisational unit responsible for module delivery	Department of Piped Utility Systems
Module co-ordinator	Łukasz Orman, PhD hab., Eng.
Approved by:	Prof. Andrzej Kuliczowski, PhD hab., Eng.

### B. MODULE OVERVIEW

Module type	core module (core/programme-specific/elective HES*)
Module status	compulsory module (compulsory/optional)
Language of module delivery	<b>Polish/English</b>
Semester in the programme of study in which the module is taught	semester 6
Semester in the academic year in which the module is taught	summer semester (winter semester/summer semester)
Pre-requisites	None (module code/module title, where appropriate)
Examination required	Yes (Yes/No)
ECTS credits	4

\* elective HES – elective modules in the Humanities and Economic and Social Sciences

Mode of instruction	lectures	classes	laboratories	project	others
Total hours per semester	15			30	



### C. LEARNING OUTCOMES AND ASSESSMENT METHODS

<b>Module aims</b>	The aim of the module is to familiarise students with the processes of air processing as well as maintaining the required parameters. Another aim is to master the ability of providing calculations for ventilation and air conditioning installation as well as selecting the required devices.
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Module outcome code	Module learning outcomes	Mode of instruction (l/c/lab/p/ others)	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student knows legal and standardisation regulations which concern ventilation and air conditioning.	l/p	IS_W10	T1A_W04 T1A_W05 T1A_W06 T1A_W07
W_02	A student knows the division and principles of operation as regards ventilation and air conditioning (as well as the conditions of air circulation in a room)	l/p	IS_W12 IS_W10	T1A_W03 T1A_W04 T1A_W05 T1A_W06 T1A_W07
W_03	A student knows the sources of air pollution and the equations of dilution as well the sources of heat gains and losses.	l/p	IS_W10	T1A_W04 T1A_W05 T1A_W06 T1A_W07
W_04	A student knows the properties of humid air and the resulting conditions for designing air conditioning.	l/p	IS_W10	T1A_W04 T1A_W05 T1A_W06 T1A_W07
W_05	A student knows the types and tasks of air conditioners and fans.	l/p	IS_W10	T1A_W04 T1A_W05 T1A_W06 T1A_W07
U_01	A student can use the Mollier diagram and utilise it in designing air conditioning.	l/p	IS_U19	T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14 T1A_U15 T1A_U16
U_02	A student can select the elements of the ventilation and air conditioning system; a student can also select its basic project solution.	l/p	IS_U19	T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14 T1A_U15 T1A_U16
U_03	A student can make calculations concerning the amount of ventilation air and make hydraulic calculations of ducts.	l/p	IS_U19	T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14



				T1A_U15 T1A_U16
K_01	A student is responsible for the reliability of the obtained results.	p	IŚ_K02 IŚ_K07	T1A_K02 T1A_K05 T1A_K07
K_02	A student can formulate conclusions and describe the results of the obtained work.	p	IŚ_K07	T1A_K07

### Module content:

#### 1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1.	Introductory information, legal and standardisation regulations concerning ventilation and air conditioning in buildings.	W_01
2.	The classification and characteristics of ventilation and air conditioning systems. Natural, mechanical, and hybrid ventilation. The tasks of ventilation and air conditioning.	W_02 U_02
3.	Air circulation in a room. The methods of realising air inflow to a room.	W_02 U_02
4.	The sources of air pollution, the issues of internal air quality. Air exchange.	W_03 U_03
5.	The equation of dilution; man-environment heat exchange; the assessment of thermal environments (PMV and PPD). Heat gains and losses.	W_03 U_03
6.	The properties of humid air, Mollier diagrams in calculating the conditions of microclimate, designing air conditioning and selecting devices. Air conditioning units.	W_04 U_01 U_02
7.	The types and tasks of fans. Selecting a fan. Calculating and selecting air ducts.	W_05 U_02 U_03

#### 2. Topics to be covered in the project

No.	Topics	Module outcome code
1.	Introduction to projects. Legal regulations. The difference between ventilation and air conditioning.	W_01
2.	Calculating the quality of ventilation air (diverse methods).	W_03 U_03 K_01 K_02
3.	Calculating heat gains as the fundamental of air conditioning air balance.	W_03 U_03 K_01 K_02
4.	The Mollier diagram (transitions and processes).	W_04 U_01 K_01 K_02
5.	Selecting a ventilation system (supply, exhaust, and supply-exhaust).	W_02 U_02 K_01 K_02
6.	The method of distributing supply and exhaust elements.	W_02 U_02 K_01 K_02
7.	The method of leading ducts in buildings; limit air velocity in ventilation ducts.	W_02 U_02 K_01 K_02
8.	Air flow in ducts/channels (static and dynamic pressure).	U_03



		K_01 K_02
9.	Hydraulic calculations (ventilator pressure and its selection).	W_05 U_03 K_01 K_02
10.	Legal regulations concerning the positioning/location of ventilation devices on roofs and walls of buildings. Selecting such devices.	W_01 K_01 K_02

### Assessment methods

Module outcome code	Assessment methods <i>(Method of assessment; for module skills – reference to specific project, laboratory and similar tasks)</i>
W_01	A test and a project
W_02	A test and a project
W_03	A test and a project
W_04	A test and a project
W_05	A test and a project
U_01	A test and a project
U_02	A test and a project
U_03	A test and a project
K_01	A project
K_02	A project

### D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	Study time/ credits
1	Contact hours: participation in lectures	15
2	Contact hours: participation in classes	
3	Contact hours: participation in laboratories	
4	Contact hours: attendance at office hours (2-3 appointments per semester)	3
5	Contact hours: participation in project-based classes	30
6	Contact hours: meetings with a project module leader	4
7	Contact hours: attendance at an examination	2
8		
9	<b>Number of contact hours</b>	<b>54</b> <i>(total)</i>
10	<b>Number of ECTS credits for contact hours</b> <i>(1 ECTS credit = 25-30 hours of study time)</i>	<b>2.16</b>
11	Private study hours: background reading for lectures	10
12	Private study hours: preparation for classes	



13	Private study hours: preparation for tests	5
14	Private study hours: preparation for laboratories	
15	Private study hours: writing reports	
16	Private study hours: preparation for a final test in laboratories	
17	Private study hours: preparation of a project/a design specification	23
18	Private study hours: preparation for an examination	8
19		
20	<b>Number of private study hours</b>	<b>46</b> <i>(total)</i>
21	<b>Number of ECTS credits for private study hours</b> <i>(1 ECTS credit =25-30 hours of study time)</i>	<b>1.84</b>
22	<b>Total study time</b>	<b>100</b>
23	<b>Total ECTS credits for the module</b> <i>(1 ECTS credit =25-30 hours of study time)</i>	<b>4</b>
24	<b>Number of practice-based hours</b> <i>Total practice-based hours</i>	<b>57</b>
25	<b>Number of ECTS credits for practice-based hours</b> <i>(1 ECTS credit =25-30 hours of study time)</i>	<b>2.28</b>

### E. READING LIST

References	<ol style="list-style-type: none"><li>1. Vedavarz A., Kumar S., Hussain M.I., HVAC: handbook of heating, ventilation and air conditioning for design and implementation, <a href="#">New York: Industrial Press, 2007.</a></li><li>2. McQuiston F.C., Parker J.D., Spitler J.D., Heating, ventilating, and air conditioning: analysis and design <a href="#">Hoboken: John Wiley &amp; Sons, 2005.</a></li><li>3. Kreider J.F., Handbook of heating ventilation, and air conditioning, <a href="#">Boca Raton: CRC Press, 2001.</a></li><li>4. Haines R.W., Hittle D.C., Control systems for heating, ventilating, and air conditioning, New York: Springer, cop. 2003.</li><li>5. Rodger Edwards, Handbook of domestic ventilation, <a href="#">Amsterdam: Elsevier Butterworth-Heinemann, 2005.</a></li><li>6. Santamouris M., Wouters P., <a href="#">Building ventilation : the state of the art.</a>, London; Sterling: Earthscan, cop. 2006.</li><li>7. <a href="#">Pisarev V., Rabczak R.</a>, Some issues of ventilation and air conditioning systems, <a href="#">Rzeszów: Oficyna Wydawnicza Politechniki Rzeszowskiej, 2015.</a></li></ol>
Module website	